Endowments, Market Potential, and Industrial Location: Evidence from Interwar Poland (1918-1939)

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Abstract
The paper explores the determinants of industry location across interwar Poland. After more than 120 years of political and economic separation, Poland was reunified at the end of 1918. In consequence, its industry faced massive structural changes: the removal of internal tariff barriers and improved infrastructure strengthened the domestic market, while foreign market relations were cut off. Similarly, the geographical dispersion of factor endowments was changed through internal migration and new institutional arrangements (education system, patent laws, etc.). How did these forces interact to determine the location of industry? Did a new interregional division of labour emerge after unification? We survey the dynamics of industrial location between 1925 and 1937 and estimate a specification that nests market potential and comparative advantage to quantify their respective impact over time. The results point to a role for both, comparative advantage and market potential, but there was a dominating and ever increasing impact of the availability of skilled labour.

Keywords: Industrial Location, Endowments, Market Potential, Interwar Poland
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Introduction

A popular concern about economic integration (or "globalisation") is that the removal of barriers to trade and factor mobility will deepen initial differences in the spatial distribution of economic activity. Apart from various motivations for this concern outside of economic reasoning, the key economic argument is linked to the size or "potential" of a market. Intuitively, firms will tend to settle at those locations that minimize transport and communication costs related to inputs (supply) and outputs (demand), and hence to settle at the market which is largest in terms of economic activity. Under some further assumptions this can give rise to a process of cumulative causation such that even a small temporary shock in market size at one of two initially identical locations could lead to a permanent more-than-proportional increase in its final share of total economic activity (Ottaviano and Thisse 2003). While this is an old idea (see Rosenstein-Rodan 1943, Myrdal 1957, Hirschman 1958), the crucial assumptions for this to hold - namely the presence of a spatially limited non-convexity in at least one market - and its microfoundations were only recently developed in the wake of the New Economic Geography (NEG).

However, many economists would probably doubt that those mechanisms are very important. The "mainstream" prediction still seems to be that better economic integration will tend to equalize initial differences in the spatial distribution of economic activity. The key reference here is neoclassical trade and location theory, mainly the Heckscher-Ohlin-Vanek models. The benchmark HOV-model, which abstracts from transport and communication costs, implies that the distribution of economic activity is uniquely determined by the distribution of comparative advantage, i.e. by endowments and technology available at one location relative to that available at alternative locations (see Brülhart 1998). In equilibrium, locations will specialize since all economic activity will settle at locations with a matching comparative advantage. Moreover, under some further assumptions derived in Samuelson (1948, 1949), free trade will ensure that the levels of economic activity as measured in factor prices will tend to converge, possibly to be equalized across all locations. The introduction of transport costs into these models does not alter this prediction, since economic integration, defined as a reduction in transport costs, will bring us back towards the outcome of the benchmark model.

Thus, initial differences in the spatial distribution of economic activity might increase, but they might equally well decrease because of better economic integration. From a theoretical perspective, this question cannot be answered ex ante, since HOV- and NEG-type mechanisms might be at work simultaneously, potentially offsetting each other. Also, studies into the ex post impact of deeper integration on the spatial structure of economic activities produced rather ambiguous results (see Brülhart and Traeger 2003). This motivates a more recent empirical literature to shift the focus away from potential outcomes of integration towards a more structural analysis of the underlying mechanisms. Recent studies on the location of economic activity, such as Davis and Weinstein (1999, 2003), Amiti (1999), Ellison and Glaeser (1999), Haaland et al. (1999) and Midelfart-Knarvik et al. (2000, 2001) all argue along two lines. First, NEG- and HOV-models are not mutually exclusive but rather stress different aspects of a trade-off situation that firms (or migrants) face with respect to their location choice. Therefore, any empirical assessment is about testing the relative rather than the absolute relevance of those models, and "about conditional rather than general validation" (Brülhart 1998). Second, all location theories rely on the interaction of location characteristics with the characteristics of a certain economic activity. HOV-theories predict that industries which heavily depend on the usage of a certain endowment will tend to settle at locations with a comparative advantage in that endowment. Similarly, but maybe less obviously, NEG-theories predict that the impact of a location's market potential increases in the industries' sensitivity to input and output linkages. Hence, there is a guideline for empirical analysis: one should try to explain the relative size of different economic activities at different locations by a set of HOV-type and NEG-type interactions between industry and location characteristics.

The majority of empirical studies consider the process of recent international economic integration and its impact on industrial structure. This simple fact implies some problems. First, one has to be very careful with data comparability in an international context. Not only exchange rate variability but also differences in data definitions or survey methods might (and most probably do) contaminate the statistics. This complicates the empirical assessment of economic integration and its changes over time, but also the measurement of economic activity across locations. Second, studies on the determinants of industrial location in modern states must be aware of interventionist policy, which might have a considerable impact on the location choices. Especially industrial location across the EU cannot be analysed without paying attention to this issue. However, it is hard to identify its influence

properly, since the channels of policy intervention range from direct subsidies to certain locations over labour market instruments to infrastructure policies.

This paper examines industrial location for the historical case of interwar Poland, which is appealing for exactly these two reasons. Since the late 18th century Poland had been politically and economically partitioned into several areas between Russia, Prussia, and the Habsburg monarchy. After Poland's political reunification in 1918, these areas experienced a quick and rather complete economic integration. In turn, that process of increased economic integration can be measured by strictly comparable panel data on prices and domestic trade volumes across the new Polish state as published by the Main Statistical Office (GUS) at Warsaw. Thereby, the Polish case can be seen as a case of "inter-national" integration in a nutshell. There is panel data on industrial employment from the Polish Labour Inspection that allows describing the evolution of industrial location across Poland between 1925 and 1937 in some detail. And in difference to most developed economies, Poland had virtually no industrial policy up to 1936 (Landau and Tomaszewski 1999, page 248-50). Hence, in absence of noise from policy intervention and based on comparable data, we can hope to find evidence about the economic mechanisms at work to determine the location of industry across the new Polish state.

The rest of the paper is organized in 5 sections. Section 1 gives detailed historical background to interwar Poland and reviews the evidence on economic integration across its different areas. Next, we will follow the mentioned guidelines for empirical analysis and try to explain the relative size of different economic activities at different locations by a set of HOV-type and NEG-type interactions between industry and location characteristics. To this end, section 2 examines how integration affected the characteristics of locations, namely their comparative advantages and their market potentials and how industries differed in their sensitivity to those characteristics. Section 3 surveys the evidence on industry location across Poland. In section 4 we estimate the actual impact of possible determinants on industry location, discuss the results and perform some stability analysis. Section 5 summarizes the evidence and concludes.

1. Economic integration in interwar Poland – background and evidence

Between 1772 and 1795, the noblemen's republic of Poland (*Rzeczpospolita Polska*) was divided into three parts between the empires of tsarist Russia, the Habsburg monarchy and the emergent Prussia. As a consequence of the partitions - "the first very great breach in the modern political system of Europe" (Edmund Burke) - Poland disappeared from the map. Only the specific constellation at the end of the First World War, where all three partition powers were severely weakened through war and revolution, opened the way for its restoration.

The area of Poland in mid-1918 can be described as a power vacuum in central Europe, with several political and military authorities struggling for influence over a territory without clearly shaped borders. As a rough approximation this territory consisted of four distinct parts: the three parts of the former *Rzeczpospolita*, which Russia, Prussia and the Habsburg monarchy until 1795 had divided between themselves, and some territories in the east that were claimed by several Polish politicians. In official statistics, the state was from 1921 onwards organized in 17 administrative units (vojvodships) that followed the former partition borders. These units are often found to be aggregated into those four groups: the western, southern and central vojvodships, covering approximately the former partition areas, and the eastern vojvodships, covering the newly attained areas in the east.[1] The area of the central vojvodships is approximately congruent with the former "Kingdom of Poland" that until the Polish insurrection in 1863 had autonomy within the Russian empire. Map 1 shows the borders of Poland as in 1921, and indicates the former partition borders. Map 2 shows that the administrative borders of vojvodships followed the former partition borders.[2]

The devastations of the First World War affected 90% of this area, destroyed the harvest and the livestock, buildings and machines, bridges and railways. Even more damage was done by the exploitation through the German and Russian occupants during the war and sabotage during their retreat (Duda and Orlowski 1999, page 231). But the major challenge to building up a Polish state was to unify its different parts. Owing to the long period of partition, there were different legislations about virtually all aspects of social, political and economic life. Tariffs, regulations, and a lack of transport and communication facilities

[1] Western vojvodships comprised: Poznań, Pomerania, Silesia; central: city of Warsaw, Warsaw, Lódź, Kielce, Lublin, Białystok; southern: Kraków, Lwów, Stanisławów, Tarnopol; eastern: Wilno, Nowogrod, Polesia, Wolhynia; see *Mały Rocznik Statystyczny*, Warsaw (1939).

[2] The only exception to this rule is the vojvodship of Białystok, where only the western part belonged to the former Kingdom of Poland, see Map 2.

prevented people from reacting to those different legislations. So presumably the Polish economy was not only devastated by a war, but it was also quite inefficient across the four parts of Poland already before the war.

We can illustrate these inefficiencies with a look at prices before World War One. Consider an efficient integrated market. Then prices should only temporarily deviate from the Law of One Price (LOP), since any price differential between two locations gives rise to arbitrage that in turn makes the differential disappear. If arbitrage involves a cost (such as tariffs, taxes, or transportation cost) - which is usually the case - then arbitrage prevents the price differentials to exceed that cost, but we expect to find in equilibrium positive price dispersion across locations. Hence, we would expect that prices within a certain group of vojvodships, i.e. within a partition border, should be closer to the LOP than prices across the partition borders. Importantly, this should hold even after controlling for distance, since we expect price wedges between any two locations to increase in their distance. Table 1 gives for the four parts of Poland mentioned the coefficient of variation (CV) – the standard deviation of the sample normalized by its mean – for an aggregate of 16 food prices as in 1914 and for land (per hectare) as in 1913. We take the CV in order to make food and land price evidence comparable. Since we expect the CV to increase in distance, we standardize it by the mean distance between the vojvodships of each group. Table 1 shows three things. First, we see that indeed, before World War One prices within the borders are in general closer to the LOP than across them. For example, the second column states that in 1914 food prices deviate by 2% around their mean every 100 km within the former Kingdom of Poland, but by 3.8% every 100 km on the whole area of Poland in its interwar borders. Second, we see that this even holds for the price of a non-tradable good such as land, which is only indirectly affected by economic integration, e.g. through migration. Third, there are striking differences between the areas. In particular, the former German partition area (western vojvodships) differs from the rest, which is a caveat for our further work to treat these areas separately.

Therefore, from an economic point of view the task was to unify the institutional framework and to improve the facilities for transport and communication in order to remove these inefficiencies. It seems that a majority of Polish politicians understood that task when the situation gradually stabilized in November 1918. The government could actually rely on extensive programs for legal, administrative and economic unification that had been prepared since 1907 for a future Polish state. However, the agenda was not set by any political or

economic "master plan", but rather by the ongoing war that Polish troops fought with the Soviet army in the east.[3]

The war required massive outlays and some mechanism to finance them. Since international credit was not available – the Paris peace conference did not start before January 1919, and Poland was yet to be formally recognized as a state -, the government had to choose between the expropriation ("nationalisation") of domestic private capital and some mechanism to tax it (Landau and Tomaszewski 1999). The political compromise in 1919 relied on early concessions to the socialists on the one hand (the eight-hour working day was introduced already in November 1918, see Landau 1992) and observing private property rights on the other. As a consequence, the next step was to create the institutional framework necessary to tax capital and labour: a common currency and a working fiscal administration. The unification of the fiscal administration belonged to the very first institutional changes. While for the southern and central vojvodships this was formally reached already in April 1919, the former German parts remained separated until January 1922, (Upper) Silesia even until June 1922.[4] A common income tax was decreed in July 1920, but, because of administrative difficulties, it took several years to implement it on the former Russian territories. Business taxes in turn were introduced and unified on the whole territory until July 1925, following the Russian system of business certifications. However, some differences of the tax system – e.g. the real estate tax – remained persistent until 1936. [5]

The precondition for any tax system to work was the creation of a common currency area, namely the unification of the five (!) currencies that were in circulation on the Polish territory: the German Mark, the Austrian Crown, and the Russian Rouble, as well as the Polish Mark in the Kingdom of Poland and the "Ost-Rubel" on the territory of "Ober Ost"[6]- two currencies that the Germans introduced on former Russian territories after their occupation. Since the Warsaw government only controlled the Polish Mark, it adopted a stepwise strategy to get rid of the competing banknotes (Landau 1992). Some months after the introduction of the Polish Mark as a parallel currency in the different areas, the other currencies were withdrawn. For the central, southern and western vojvodships, this was realized already in April 1920, with the exception of Upper Silesia (Nov. 1923).[7] While such

[3] For the following see Zbigniew Landau (1992), and Wojciech Roszkowski (1992).
[4] See B. Markowski (1927), and Michał Bielak (1931).
[5] For details see Ignacy Weinfeld (1935).
[6] "Ober Ost" was a German military state, founded in 1915 by the General Ludendorff, on the territory of the former Grand Duchy of Lithuania. See Vejas G. Liulevicius (2000), *War Land on the Eastern Front: Culture, National Identity and German Occupation in World War I*, Cambridge MA: Cambridge University Press.
[7] See Wiesław Zbijewski (1931).

a quick institutional change was an indisputable success, it could not create the necessary revenues to win a war. But it opened the way for the Polish government to effectively tax money holders by inflation. As estimated by Zdziechowski (1925), the money supply increased between 1918 and 1919 by 519 %, in the following year by another 929 %, to reach in 1923 more than 12 000000 % (!) of the level in 1918.[8] Obviously, the temporal gains from seigniorage and the devaluation of the budget deficit were quickly wiped out by the costs of hyperinflation, namely the loss of access to foreign capital. When Prime Minister Władysław Grabski tried to stabilize the currency in 1924, his definite aim was to link the Polish currency with some foreign currency that had successfully restored the gold standard in order to get access to the international capital market. Indeed, Grabski managed to realize this task with the help of a temporary property tax, fixed in Swiss gold francs, and several international loans. Already in mid January 1924 the nominal exchange rate was stabilized and a new currency, the Złoty, was fixed par with the Swiss gold franc, i.e. 1 Złoty= 9/31 gram of pure gold. A new institution, the Bank Polski S.A., was introduced with the exclusive right to issue banknotes, while the government kept the right to issue coins (Zbijewski 1931). The fixed parity turned out to be an overvaluation, which had to be corrected in several devaluations of the Złoty from July 1925 on, but it nevertheless prepared the ground for a stable currency. The exchange rate stabilized at a sustainable level around May 1926, while formally the new parity was fixed only in October 1927 at 1 Złoty = 1000/5924.44 gram of pure gold.[9] From now on the government started to defend the parity at any cost, adhering to the gold standard until 1936.

The war in the east also had a direct impact on the transportation system, since it required a network to transport men and material. After rather spontaneous takeovers of the railway networks in the different areas during the last months of the First World War, already in October 1918 a railway ministry started its work and developed a 10-years plan for the completion and extension of the polish railway network. At the same time the heritage of 129 types of cars and 165 types of engines had to be unified, new kinds of freight cars had to be developed (e.g. refrigerator wagons), the different densities of the network adjusted and the main economic centres of the former partition areas connected.[10] The speed of the network and its capacity to transport goods was not only a function of the existence of railway

[8] See Jerzy Zdziechowski (1925).
[9] See Dziennik Ustaw RP, Nr. 88, poz. 790, Warsaw, 1927.
[10] B. Hummel (1939), *Odbudowa i utrzymanie kolei* [Rebuilding And Maintenance Of Railways] in: *Dwudziestolecie komunikacji w Polsce Odrodzonej* [20 Years of Communication in a Reborn Poland], Kraków, p. 146.

connections themselves, but also crucially depended on the material used. Table 2 gives an overview for the development of important newly built railway lines and the changes in speed. Since nearly all freight transport took place on railways with normal gauge (97.6% in 1925 and 98.7% in 1938),[11] this development of the railway network can be expected to have had a strong integrating impact on the economy.

Thus the most obvious *non-tariff* barriers to trade and mobility within the new Polish state such as different currencies, different tax systems, and shortage of transport facilities were considerably reduced if not completely removed until 1926. The *tariff* barriers were removed already until mid-1921. One of the first steps to unify the new economy was the introduction of a common external tariff in November 1919. But it took some more time to get rid of internal tariffs and a system of widespread regulations of commodity and factor markets. Again, in part this system was motivated by the need to furnish the Polish troops, fighting with the Soviet army in the east, but it had also aspects of political logrolling between different groups. Especially the markets for agricultural products (e.g. bread, grain, potato, sugar) and basic commodities (e.g. coal, soap, matches) were affected by a variety of measures that discriminated between regions and social groups. For example, there remained a customs frontier between the former Prussian partition area and the rest. This kept grain prices in that area at an artificially low level, thereby providing cheap supply for the fighting troops.[12] After the armistice between Poland and Soviet Russia the Polish government launched a program to liquidate the whole system of regulations. The internal customs frontier was removed in mid-1921, and until the end of 1921 most other regulations on the commodity markets had disappeared.[13]

Evidence from price and domestic trade indicates that indeed the Polish economy integrated to a considerable degree (see Wolf 2003, pp. 21-69). Similar to table 1 we can illustrate this with a look at price dispersion across Poland. The Polish Statistical Office (GUS) published for the years 1924 till 1937 an index of food prices that aggregated price data for 16 goods across 175 cities, from 1934 on across 209 cities.[14] The city-level data was aggregated along the 17 vojvodships using city population as a weighting scheme and was

[11] E. Brzosko (1982), also Roman Buczyński*, Struktura rynku zbożowego w Polsce. Referat opracowany dla Komisji Kontroli Cen* [The structure of agricultural markets in Poland. Report at the Commission for Price Regulations], Warsaw (1939), pp. 91ff.
[12] Krzysztof Kozłowski (1989), p. 157 and Zbigniew Landau and Jerzy Tomaszewski (1999), p. 69.
[13] Jerzy Tomaszewski (1966), also Kozłowski (1989), p.158.
[14] The source is for 1924 – 1929 *Rocznik Statystyczny* [Statistical Yearbook], Warsaw (diff. years), and for 1930 – 1937 the periodical *Statystyka Cen [*Price Statistics], Warsaw (diff. years). The commodities contained are rye-bread, wheat flour, barley gruel, beans, rice, potatoes, milk, eggs, butter, bacon, sausages, beef, sugar, salt, tea, and coffee.

published as a cross-section index for the vojvodships relative to the city of Warsaw. Hence, the publication gives the mean of 16 food prices of the mean of all cities in a vojvodship relative to the mean of that 16 food prices at Warsaw city. This allows us to derive - in the spirit of Engel and Rogers (1996) - a simple but powerful statistic of market integration on a rather complete panel across Poland. We argued above that in presence of arbitrage costs (such as tariffs, taxes, transportation costs, etc.) we expect to find in equilibrium a positive price dispersion across locations. Integration in turn, i.e. the reduction of tariff and non-tariff barriers to trade should show up in a lower equilibrium price dispersion across locations. The cross-section index data on the vojvodships gives us a sample of 120 independent price ratios. Graph 1 gives the annual standard deviation of each price ratio between locations i, j defined as in Engel and Rogers (1996). The bold line is the sample mean.

Clearly, the mean price dispersion decreased a lot. And we see that this indeed happened during and shortly after the period of massive efforts to unify the institutional framework. The two peaks of increased price dispersion in 1932 and 1934 are due to price movements in the western vojvodships. At the end of the period, the Polish food markets were integrated to a quite high degree, comparable to that of France during the late 19th century (see Wolf 2001). Complementary evidence on Polish domestic trade proves that we are allowed to generalize this result for Poland as a whole. We can safely conclude that the Polish economy was rather well integrated from the mid-1920s onwards, if compared to similar evidence on price and trade data across the contemporary EU (see Wolf 2002). So what about the impact of that integration on the location of industry ?

2. Tracking comparative advantage and market potential over time

In order to match the available evidence on industrial location and its potential determinants, we need to aggregate the data up to congruent areas. The data allows us to distinguish between the three former partition areas, and additional sub-areas, namely within the former German partition area, and within the former Russian partition area. This leads us to define five big regions as shown in Map 3. Let us term them RussiaCentral (congruent with the vojvodships of Warsaw, Warsaw city and Lódź, i.e. the main part of the former Kingdom of Poland), RussianEast (congruent with the rest of the former Russian part of Poland), Prussia (congruent with the vojvodships of Pomerania and Poznań), Silesia (congruent with the

vojvodship of Katowice), and Austria (congruent with the formerly Austrian southern vojvodships).

The integration of those areas presumably affected the location of industry through a multitude of channels. The removal of barriers enhanced not only domestic trade, but possibly also factor movements and the dispersion of knowledge, i.e. it changed the area's comparative advantages. In addition - as stressed by the New Economic Geography - the definition of new national borders and the removal of former borders within Poland obviously affected local market potentials in every part of Poland. Table 3 summarizes the evidence on comparative advantage for the five parts of Poland that is available for the period 1926-1934: the areas' share in Poland's mineral resources (coal, petrol, other fuels), the abundance of labour as measured by total population per usable land (i.e. excluding lakes, marshlands, etc.), the availability of skilled labour (i.e. labour literate in Polish language as share of an area's total population), and the areas' share in total patent announcements. The different sources of that data and the construction of variables are described in appendix. Since the regions are of very different size, we also give their respective share of Poland's territory.

For mineral resources we just give the mean over the period, because their shares were constant over time. Note that the rather small area of Silesia possessed about 64% of all Polish mineral resources. In addition, it was very labour abundant and endowed with a quite highly skilled labour force. The area of Austria initially had a high share in patent announcements, which decreased over the period. This might be related to the fact that the only two universities on the area of Poland before World War I, Lwów and Kraków, were situated in that part, but lost importance after the installation of universities and colleges at Warsaw, Poznań, and other cities. Especially Warsaw became a centre of innovative activities. Skilled labour was best available in the former German parts of Poland, Silesia and Prussia. However, since our measure refers to the share of population that is literate in Polish language it implies a "Polish bias" due to the ethnic composition of the respective population. This composition was rather homogeneous in the western parts of Poland, and rather inhomogeneous in the east. Nevertheless, it makes sense to ask whether the availability of people able to read and write in Polish language had an impact on the location of industry.

Next, we turn to the areas' market potential. As argued in the introduction, a key idea in location theory is that firms tend to settle at those locations that minimize transport and communication costs related to inputs (supply) and outputs (demand), and hence to settle at the market with the highest market potential. There are different approaches in the literature

on how to measure a location's market potential, i.e. its access to purchasing power across the economy. The standard is still Harris (1954) who proposed a rather ad hoc formula, where market potential of location j (MP_j) increases in purchasing power (PP_j) of all locations i, but decreases in distance ($dist_{ij}$) to j:

$$MP_j(Harris) = \sum_i \frac{PP_i}{dist_{ij}}. \tag{1}$$

Redding and Venables (2001) suggest that we can easily derive such a function from a standard gravity-model and thereby estimate its functional form. As shown in Wolf (2002) one can estimate such a gravity model in the case of interwar Poland based on a rich set of bilateral domestic trade data between the different parts of Poland. Moreover, this allows us to keep track of economic integration, in our case to include the changing impact of the former partition borders. We estimate the following specification:

$$\begin{aligned}\log(X_{ij,t}) = \sum_{k=1}^{K} \beta_k + \beta_2 \log(Y_{i,t}) + \beta_3 \log(Y_{j,t}) + \beta_4 \log(dist_{ij}) \\ + \beta_5 \log(REM_{i,t}) + \beta_6 (Adjacency_{ij}) + \sum_n \beta_n parbord^n_{ij} + \varepsilon_{ij,t},\end{aligned} \tag{2}$$

where $X_{i,t}$ is the value of aggregate bilateral trade between two areas I and j at time t, K is the number of areas under inspection, β_k captures area-specific fixed effects of area k, $Y_{i,t}$ and $Y_{j,t}$ capture the size of the importing and the exporting area at time t, respectively, $dist_{ij}$ is a distance variable, and $REM_{i,t}$ controls for remoteness of area i relative to other areas at time t (see Helliwell 1997). With $Adjacency_{ij}$, we also control for neighbourhood-effects, which often prove to have a significant impact in similar specifications (see Nitsch 2000). The border dummy $parbord^n_{ij}$ takes the value of one if only one of two locations i and j was formerly part of partition area n, and zero otherwise.

Following Redding and Venables (2001), this leads us to a measure of market potential, which is now increasing in the importing region's economic size, decreasing in the estimated impact of distance, and changing with the border effects, remoteness, adjacency, and area fixed effects that we all found to influence domestic market relations:

$$\begin{aligned}MP_j = \exp(1)^{\beta j} \{\sum_k^K [(Y_k)^{\beta 2} (dist_{jk})^{\beta 4} \\ (REM_j)^{\beta 5} \exp(Adjacency_{jk})^{\beta 6} \sum_n \exp(parbord^n_{jk})^{\beta n}]\}.\end{aligned} \tag{3}$$

Table 4 shows how the share of market potential of the five big regions changed over time. Again, for the sake of comparison we also give the regions' shares in Poland's territory.

Thus it was *not* the geographical centre of Poland which had the highest market potential, but due to the long period of political and economic partition the rather peripheral regions. This changed somewhat between 1926 and 1934, when the central area around Warsaw improved its relative position within the domestic market, but this process was apparently rather slow. Note that the huge eastern part of the former Russian partition area possessed only a minor part of Poland's total market potential, while Silesia's, as well as Austria's and Prussia's shares were rather large in relation to their area. Obviously, the changes in comparative advantage and market potential did affect different industries in a different manner. As usual in trade theory, we might distinguish the industries by their respective "factor intensities", i.e. their sensitivity to changes in a given endowment or market potential. However, it is not an easy task to collect such data for different industries in interwar Poland. Table 5 gives the available evidence for ten different industries. In addition, as opposed to the above time series evidence on locations characteristics, the availability of data forces us to assume that these industry characteristics did not change over time.[15] Again, the different data sources are given in appendix.

We expect that an industry with high fuel consumption such as metallurgy will react more to differences in the locations' endowment with mineral resources than one with virtually no fuel consumption such as the printing industry. The same holds for interactions between labour abundance and labour intensity, availability of skilled labour and skill-intensity and patent production and patent-intensity. It is less obvious how industries should differ in their sensitivity to market potential. Theory suggests that there might be three channels, namely output (or demand or "backward") linkages, input (or supply or "forward") linkages, and firm level market power or some externalities, which strengthen or weaken these linkages. We expect industries with a high share of final demand in their total sales to react more to the size of a market, since a bigger market implies lower retail costs: a backward linkage. And we expect industries with a high share of intermediates in their gross value of output to react more to the size of a market, since a bigger market corresponds to better access to supply: a forward linkage. Finally, NEG-models imply that these linkages differ in industry-specific market power at the firm level (see Neary 2001, pp. 542-45). A simple proxy for this is the mean firm size of an industry as measured in total annual sales per

[15] This assumption needs to be made even for contemporaneous studies on industry location, see for example Midelfart-Knarvik et al. (2000, 2001).

number of active plants. That is, we expect backward and forward linkages to interact not only with market potential, but also with this proxy for firm level market power. As shown in the table, our data on Poland allows us to explore the relevance of a forward linkage and firm size effects for industrial location in the presence of HOV-mechanisms.

3. Did industry location change?

Integration changed comparative advantage and market potential. But how did this translate into changes in industrial location? To measure the level of economic activity at locations we make use of the most disaggregated data set available for interwar Poland, namely employment data from the *Inspekcja Pracy* [Labour Inspection].[16] We have data for the years 1925 – 1937 that cover employment in all sectors, including agriculture. Overall, there is information on 20 economic activities, especially data on all industrial plants with more than 4 employees. The data was published for 12 "inspection districts" covering the whole territory of Poland with the exception of some parts of Silesia between 1925 and 1929. However, the lacking Silesian data is available from a different source, the *Statystyka Pracy* [Labour Statistics], published by the main statistical office (GUS).[17] Since the "inspection districts" follow the administrative borders of vojvodships, we can aggregate them up to our five big regions.

Before we describe this data set quantitatively, it is necessary to clarify some measurement issues (see Overman et al. 2003). First, we can make statements about the *specialization* of a given region. How similar were the economic structures across different regions in Poland? Do we find a regional division of labour across Poland, did this change during the interwar period? In this case, the unit of interest will be the share of a certain activity k in the total economic activity of region i ($s_i^k(t)$), defined as

$$s_i^k(t) = \frac{x_i^k(t)}{\sum_k x_i^k(t)}, \tag{4}$$

where $x^k{}_i(t)$ measures the level of economic activity k at location i and time t. Second, we can make statements about the *localization* of a given economic activity. How concentrated is

[16] *Inspekcja Pracy 1925,(...), 1937, Table 1,* Warsaw (1926 – 1938).
[17] GUS, *Statystyka Pracy* [Labour Statistics], 1928, nr. 4, pp. 259-260 and GUS, *Statystyka Pracy* [Labour Statistics], 1937, nr. 2, page 87. Also see Zbigniew Landau and Jerzy Tomaszewski (1971), *Robotnicy Przemysłowi w Polsce* [Industrial Worker in Poland], Warsaw.

economic activity as a whole and how concentrated is a given industry? Which industries tend to agglomerate, which industries are rather dispersed? And do we find an increase or decrease in concentration over time? Then the unit of interest will be $\ell_i^k(t)$, the share of a certain location i in the total economic activity of industry k, defined as

$$\ell_i^k(t) = \frac{x_i^k(t)}{\sum_i x_i^k(t)}, \tag{5}$$

where again $x^k{}_i(t)$ measures the level of economic activity k at location i and time t. Hence, localization and specialization issues capture related but different aspects of spatial developments. We expect to find at least some industrial concentration if regions are highly specialized. However, since industries and regions typically differ in size, these two measures can (and typically do) differ quite a lot. Finally, to summarize both kind of information in a single variable we can make use of the location quotient $r_i^k(t)$, that standardizes a location's specialization $s_i^k(t)$ by the industries' share in total activity and an industry's localization by the location's share in total activity:

$$r_i^k(t) = \frac{x_i^k \Big/ \sum_i x_i^k}{\sum_k x_i^k \Big/ \sum_i \sum_k x_i^k} = \frac{x_i^k \Big/ \sum_k x_i^k}{\sum_i x_i^k \Big/ \sum_i \sum_k x_i^k}. \tag{6}$$

In our estimation in section 4 we will use this location quotient as our dependent variable and investigate its determinants.

Given that, how specialized were our five regions? We can address this question by use of Krugman's specialization index K_i (t), defined as:

$$K_i(t) = \sum_k abs(s_i^k(t) - \bar{s}_i^k(t)), \qquad K \in [0,2] \tag{7}$$

where $\bar{s}_i^k(t)$ is the share of industry k in the total production of all regions *except* region i. Thus, the Krugman index summarizes a region's differences in specialization with respect to the rest of Poland over all industries. It takes the value of zero if a region's industrial structure is identical to the rest of Poland, and the value of two if the region has no industries in common with the rest of Poland. Table 6 gives the Krugman index for all 20 economic activities (including agriculture, forestry, and mining) for the different parts of Poland.

The average, weighted by an area's total employment, is stable over time, but there is some decrease in specialization in Silesia (due to a decrease in mining) and Prussia (due to a decrease in agriculture). The index is stable for RussiaCentral, decreases for Austria, and sharply increases for RussianEast. This gives a rather cloudy picture, but we might want to drop activities that are most probably determined by invariant natural advantage, such as mining or agriculture. Anyway, since we lack sufficient data on the location determinants of other economic activities than industry, we will have to restrict our econometric analysis to the determinants of *industrial* location. If we calculate a Krugman index for industry alone, the picture gets much clearer (see table 7). There is an increase in industrial specialization from 0.31 to 0.40, interrupted by the depression period (1929-1932). To compare, the weighted average of a Krugman index applied to data of industrial production across the European Union increased from 0.33 in the 1970s to 0.35 in the 1990s.[18] In our case, RussiaCentral proves to be quite specialized, which can be traced back to the impact of its textile industry. We see now that there was an increase in *industrial* specialization for Silesia and Prussia, as well as an increase for Austria and the RussianEast. As indicated in table 8, the percentage changes in industrial specialization are indeed impressive, with an increase in the level of specialization between 14% (Silesia) and 73% (RussianEast), and a weighted average increasing by 30% over the period 1925 – 1937. Hence, the "interregional division of labour" increased during the interwar period with a temporal relapse into more self-subsistent regional economies during the depression years.

Next, does this increase in specialization correspond to a higher spatial concentration of industries? We constructed a simple index of industrial concentration as:

$$G^k(t) = \frac{1}{2}\sum_{i=1}^{N} abs(\ell_i^k(t) - area_i), \qquad G^k \in [0,1] \qquad (8)$$

where $area_i$ denotes a region's area as share in total usable area (as in 1931). This control for area is important, since otherwise size differences would contaminate the results. Table 9 summarizes the evidence.

Most industries show a slight increase in concentration, but there are remarkable exceptions. The (mainly Silesian based) mineral and metallurgical industries spread out, as well as the wood industry, which started to grow in the area of RussianEast. The overall increase in concentration is not in an obvious manner related to certain groups of industries.

[18] See Midelfart-Knarvik (2000), page 6.

"High-tech" industries, such as chemical and electrical industries tend to concentrate, but also do the leather, food, and clothing industries. We can conclude that industry location changed a lot during the period, and we expect this to be related to the process of economic integration as analysed in section 1. But the descriptive evidence does not point to any particular set of explanations. An increased interregional division of labour might be seen as evidence in favour of HOV-type mechanisms of industrial location. It might equally be seen as the flipside of a process of concentration in some industries, due to NEG-type mechanisms. What forces dominate is left to an econometric analysis.

4. Econometric analysis: what drives industrial location?

In this section we try to quantify the relevance of the described industry and location characteristics in determining the location of industry across Poland. Moreover, we want to examine whether their respective impact changed over time due to the ongoing process of economic integration (or other time-specific factors). Let us assume that both, a location's specialization $s_i^k(t)$ and an industry's localization $\ell_i^k(t)$ depend on a set of interactions between location characteristics y_i (endowments and market potential) and the industries' sensitivity with respect to those characteristics, denoted by z^k. To capture both aspects of industrial geography simultaneously we make use of the location quotient $r_i^k(t)$ as defined in (6). Consider the following specification:

$$\log(r_i^k) = \sum_i \eta_i + \sum_k \kappa^k + \beta_i^k[h] \sum_i \sum_k z^k[h] \log(y_i)[h] + \varepsilon_i^k. \qquad (9)$$

The left-hand side is the location quotient of industry k at location i in time t, which controls for size differences between locations and industries. We regress this on a set of interactions between the vector of location characteristics (in logs) and the vector of industries' sensitivities (as elasticities) denoted by $\sum_i \sum_k z^k \log(y_i)$. For each interaction [h] we estimate a separate coefficient $\beta_i^k[h]$. Finally, we add dummies to account for location and industry effects, η_i and κ^k respectively. This allows us to control for omitted variables, which are probably quite important as our data on location and industry characteristics is limited. Ellison and Glaeseer (1999) use a similar specification in their investigation into the location of US-industries, and Midelfart-Knarvik, Overman, and Venables (2000, 2001)

derive this specification from a fully specified location model to analyze industrial location across the EU.

In a first step, we want to estimate the relevance of the following five interactions between location characteristics and industry characteristics for the location of industry: we consider the interaction between

1) mineral endowments and fuel intensity,
2) labour abundance and labour intensity,
3) skill availability and skill intensity,
4) patent announcements and patent intensity, and
5) market potential and the share of intermediate inputs.

Estimation for the five regions of Poland (see map 3) is done by pooling over the 10 industries and 9 years in our sample, which gives a total of 450 observations. We use a simple pooled OLS-estimation but allow for a flexible form of heteroskedasticity across observations using White-heteroskedasticity-consistent errors. We tried several other estimation techniques including feasible GLS and SUR-estimators that delivered very similar results. Table 10 gives the results of a pooled OLS-estimation with fixed effects, where we first restrict all coefficients to be stable over the whole period, and then split the sample into three sub-periods of equal length (1926-28, 1929-31, 1932-34).[19]

Let us focus on the interactions. Only two out of the five interactions are estimated to have a significant impact of industrial location, a third one only for the last sub-period. We do not find any evidence that NEG-type mechanisms are at work. The coefficient on the forward linkage, as implied by the interaction between a location's market potential and the industries' dependence on intermediate supply is insignificant. We do find, on the other hand, evidence in line with standard HOV-models. Not surprisingly, the availability of mineral resources seems to influence the location of fuel (or energy) intensive industries, such as the production of mineral and metallurgical products or the production of chemical goods. While the impact of mineral deposits seems to get weaker over time, the opposite holds for innovative activity as measured by patent announcements. This probably reflects the increasing role for Warsaw (located in the area of RuCentral) as a location for research and

[19] Strictly speaking we cannot estimate time-varying coefficients pooling over time, because the changes in market potential and endowments, as we described them in section 2, are probably a function of the distribution of industries at a given point in time. Hence, endogeneity bias would contaminate our findings.

research intensive industry. Finally, by far the dominant force seems to be the interaction between skill availability and skill intensity, and this mechanism gets stronger over time. That is, industries with high skill intensity such as mechanics/ electrics and the chemical industry tend indeed to locate in areas with a comparative advantage in skill endowments.

However, we might have been unfair to NEG-theory. The rather mixed results on market potential are possibly due to a misspecification. As argued above, NEG-models suggest that backward and forward linkages should get stronger in the degree of market power at the firm level, which probably varies across industries. We can try to account for this effect using our proxy for the mean firm size of an industry (see appendix for details). If we interact market potential and intermediate inputs with this additional industry characteristic [fsize], we expect to find a clearly positive coefficient: the more market power at the firm level, the stronger the linkages with market potential. Table 11 gives the results of that exercise.

With the new specification we have to modify several of our findings reported in table 10. First, the overall fit of the new specification is better than the previous one, and some of the odd results from table 10 have disappeared. Ceteris paribus there seems to be an important role for the labour/ land ratio in shaping the distribution of labour intensive industries. Next, in difference to the previous specification we do not find any more a role for the interaction between a location's endowment with mineral resources and the industries' intensity in fuel usage. While there still seems to be some tendency for the location of innovative activity to gain relevance over time, there is no significant impact any more. But the key message from table 11 is twofold: first, there is evidence of a highly significant forward linkage with respect to a location's market potential, while second the availability of skilled labour is still the dominating mechanism for industrial location, and increasingly so. Apparently, that estimated forward linkage depends on the presence of market power at the firm level. Industries with a high share of intermediates in their total production value did indeed react more to the size of a market given that we control for different mean firm sizes in these industries. Hence, according to this modified setting, both HOV- and some NEG-type mechanisms were simultaneously at work in determining industrial location in interwar Poland. But while the impact of skill endowment seems to gain importance, the forward linkage is rather stable over time.

Finally, let us ask how Poland performed compared to the integrating European Union? Our findings on interwar Poland are surprisingly similar to those of Midelfart-Knarvik et al. (2000) who estimated a specification very close to our specification, but used

data on industrial production instead of employment data to measure industrial activity across 14 member states of the EU between 1970 and 1997. They also found that both kinds of mechanisms are important to determine the location of industry, interactions based on a location's market potential as well as interactions based on a location's comparative advantage. As in the case of interwar Poland the availability of an educated labour force is found to be very important for the location of skill-intense industries across the EU, but in addition to that they identify a specific role for the availability of research staff. Furthermore, they estimate a strong and significant effect of a location's market potential, and point to the importance of forward rather than backward linkages. In contrast to our results, these forward linkages are important but need not imply a tendency towards a more unequal distribution of economic activity since they seem to be independent of the degree of competition prevailing in an industry. Obviously, these "differences" between the contemporaneous EU and our historical case might be due to measurement issues. But overall the results suggest some surprisingly stable mechanisms that might prevail in very different historical circumstances.

5. Summary and Conclusion

In this paper we analysed the determinants of industrial location in order to learn something about the impact of economic integration on economic structure in the case of Poland, but also in more general terms. Following recent studies, we tried to identify some potential mechanisms behind industrial location as suggested by HOV- and NEG-models, and we estimated their respective relevance at different points in time. The data allowed us to do this for the location of industry on a panel of five regions and ten industries between 1926 and 1934. There are three main findings. First, our evidence on the dynamics of comparative advantage and market potentials suggested that economic integration affected the economy through a multitude of channels. Internal migrations, shifting centres of innovation, and not least the diminishing impact of the former partition borders changed the regional characteristics and thereby the incentives to move industrial plants. Second, there is evidence of an increasing "interregional division of labour" across Poland during the interwar years, while the degree of spatial concentration was virtually constant over time. Third, trying to keep track of these changes in a time-specific estimation framework, we found evidence that indeed several mechanisms affected industrial location. Our results are similar, while not identical to those of Midelfart-Knarvik et al. (2000) on industrial location across the EU

between 1970 and 1997. We found a highly significant forward linkage after controlling for an industry's firm-level market power. Moreover, there was a significant interaction between a location's labour abundance and the industries' labour intensity. However, by far the most important mechanism in our case was the interaction between skill-intense industries and a location's endowment with a skilled labour force. Controlling for omitted variables with location and industry fixed effects we could show that this interaction gained importance over time.

To sum up, what happened to Poland's economy in consequence to the removal of the former partition borders? The answer is rather encouraging for those who are interested in the effects of the EU common market programme or similar projects of regional and international integration. And it might be surprising to those who are used to think about interwar Europe in terms of pathology, keeping in mind the disastrous consequences of the First World War and the Great Depression. Poland's economy integrated rather quickly, and we do not have any evidence that this integration process deepened the initially huge differences in the spatial distribution of economic activity. On the contrary, we could show that NEG-type mechanisms, while being important, were far from dominating the location of economic activity. From that perspective, the long-term economic outlook for Poland's further economic integration and regional convergence would have been quite optimistic, had this promising development not been interrupted by the German invasion in 1939.

Tables and Graphs

Table 1: Inefficiencies? Deviations from the LOP in 1913/14

	(a) Index of 16 Food Prices in 1914		(b) Land Prices (per ha) in 1913	
	Coefficient of Variation (CV)	CV per 100 km	Coefficient of Variation	CV per 100 km
within 6 central vojvodships	0.038	0.020	0.119	0.061
within 4 eastern vojvodships	0.045	0.019	0.131	0.056
within 2 western vojvodships without Silesia	0.051	0.039	0.157	0.121
within 4 southern vojvodships	0.053	0.021	0.205	0.083
Poland across partition borders	0.135	0.038	0.628	0.174

Sources: (a) *Rocznik Statystyczny za rok 1924* [Statistical Yearbook for 1924], Warsaw (1925), page 108; (b) Edward Szturm de Sztrem (1924), *Ceny* Ziemi [Land Prices], in *Kwartalnik Statystyczny*, 1924, (I/ 4), page 272.

Table 2: Important railway-connections between main cities and average length of the trip

Date of opening	Connection	Distance	Av. length of the trip (as in 1937)
1861	Kraków-Lwów	ca. 341 km	5.00 hrs
1917	Warsaw-Lwów via Lublin	ca. 500 km	8.30 hrs
1872	Warsaw-Poznań via Toruń	ca. 376 km	7.0 hrs
Nov. 1921	Warsaw-Poznań via Września	ca. 304 km	4.45 hrs
1857	Poznań-Kraków via Wrocław	ca. 380 km	n.a.
Nov. 1926	Poznań-Kraków via Wieluń	ca. 330 km	n.a.
1848	Warsaw-Kraków via Częstochowa	ca. 364 km	8.00 hrs
Nov. 1934	Warsaw-Kraków via Radom	ca. 320 km	5.20 hrs

Sources: Pisarski (1974), p. 58; Olszewicz (1938), p. 223.

Table 3: Changing endowments (1926 - 1934)

		Mineral resources	Skills			Patents			Labour abundance		
	Share in Poland's territory	mean 1926-34	1926	1930	1934	1926	1930	1934	1926	1930	1934
RuCentral	0.174	0.188	0.643	0.715	0.795	0.348	0.451	0.539	868	966	1074
RuEast	0.470	0.033	0.625	0.691	0.765	0.038	0.066	0.027	559	614	676
Prussica	0.126	0.023	0.967	0.969	0.972	0.114	0.148	0.092	663	691	722
Silesia	0.008	0.643	0.979	0.984	0.988	0.144	0.128	0.158	2388	2625	2885
Austria	0.222	0.113	0.737	0.767	0.799	0.356	0.207	0.185	1079	1146	1217

Sources: See appendix.

Table 4: Evolution of regional Market Potential (MP) as a share of total Polish Market Potential (1926-1934)

	Share in Poland's territory	1926	1927	1928	1929	1930	1931	1932	1933	1934
RuCentral	0.174	0.177	0.173	0.176	0.172	0.153	0.187	0.191	0.195	0.196
RuEast	0.470	0.149	0.148	0.150	0.147	0.134	0.164	0.167	0.170	0.173
Prussia	0.126	0.215	0.218	0.228	0.224	0.221	0.210	0.204	0.202	0.194
Silesia	0.008	0.119	0.117	0.112	0.106	0.125	0.121	0.119	0.101	0.099
Austria	0.222	0.340	0.343	0.334	0.351	0.367	0.318	0.318	0.331	0.337

Sources: See text

Table 5: industry characteristics

	Fuel intensity	Labour intensity	Skill intensity	Patent intensity	Intermediates per output	Mean firm size (IRS)
Mineral industry	0.211	0.342	0.047	0.070	0.660	0.140
Metallurgy	0.201	0.243	0.104	0.126	0.439	1.011
Mechanics / electrics	0.089	0.467	0.162	0.127	0.367	0.467
Chemicals	0.141	0.150	0.143	0.272	0.425	0.979
Textiles	0.115	0.210	0.052	0.089	0.556	0.529
Paper	0.054	0.170	0.080	0.041	0.569	0.667
Leather	0.012	0.111	0.074	0.002	0.571	0.340
Wood	0.043	0.190	0.062	0.082	0.478	0.135
Food	0.133	0.089	0.111	0.104	0.535	0.171
Printing	0.000	0.347	0.119	0.072	0.353	0.142

Sources: see appendix

Table 6: Krugman's specialization index (all activities, 1925 - 1937)

	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
Russia Central	0.697	0.683	0.718	0.741	0.599	0.594	0.587	0.603	0.630	0.640	0.660	0.682	0.686
Russia East	0.246	0.240	0.265	0.255	0.290	0.307	0.286	0.331	0.393	0.398	0.388	0.407	0.393
Prussia	0.939	0.922	0.949	0.903	0.865	0.880	0.870	0.888	0.911	0.907	0.928	0.895	0.878
Silesia	1.086	1.110	1.082	1.040	1.045	1.079	1.077	1.109	1.095	1.046	0.979	0.948	0.918
Austria	0.583	0.645	0.621	0.553	0.514	0.496	0.520	0.494	0.518	0.506	0.537	0.477	0.519
Average	0.710	0.720	0.727	0.699	0.662	0.671	0.668	0.685	0.709	0.699	0.698	0.682	0.679
Weighted average	0.670	0.681	0.692	0.670	0.640	0.652	0.648	0.653	0.672	0.670	0.673	0.660	0.654

Sources: *Inspekcja Pracy 1925 - 1937, Table 1,* Warsaw (1926 – 1938) and GUS, *Statystyka Pracy* 1928, nr. 4, pp. 259-260 and GUS, *Statystyka Pracy* 1937, nr. 2, page 87. Also see Landau and Tomaszewski (1971).

Table 7: Krugman index (industry only, 1925-1937)

	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
Russia Central	0.421	0.459	0.463	0.483	0.415	0.407	0.380	0.397	0.437	0.458	0.467	0.484	0.500
Russian East	0.159	0.163	0.178	0.199	0.197	0.200	0.184	0.200	0.238	0.246	0.232	0.274	0.276
Prussia	0.329	0.341	0.348	0.318	0.303	0.315	0.295	0.345	0.376	0.387	0.403	0.409	0.403
Silesia	0.332	0.375	0.378	0.371	0.360	0.388	0.350	0.348	0.386	0.394	0.376	0.369	0.378
Austria	0.323	0.386	0.389	0.375	0.356	0.330	0.331	0.327	0.358	0.358	0.371	0.361	0.396
Average	0.313	0.345	0.351	0.349	0.326	0.328	0.308	0.323	0.359	0.369	0.370	0.380	0.390
Weighted average	0.307	0.339	0.349	0.349	0.327	0.329	0.310	0.327	0.361	0.372	0.376	0.389	0.397

Sources: See table 6.

Table 8: Specialization Dynamics
(Percentage Change in Krugman index, industry only, 1925-1937)

	1926/25	1927/26	1928/27	1929/28	1930/29	1931/30	1932/31	1933/32	1934/33	1935/34	1936/35	1937/36	1937/1925
Russia Central	9.01	0.95	4.36	-14.2	-1.86	-6.63	4.42	10.04	4.84	2.12	3.63	3.19	18.80
Russian East	2.30	9.19	12.04	-1.02	1.39	-7.81	8.77	18.83	3.33	-5.66	18.00	0.59	73.15
Prussia	3.80	2.02	-8.50	-4.82	4.06	-6.52	16.98	8.98	3.02	4.07	1.44	-1.54	22.47
Silesia	12.89	0.79	-1.91	-2.95	7.91	-9.92	-0.49	11.04	1.95	-4.66	-1.70	2.45	13.89
Austria	19.35	0.89	-3.61	-5.12	-7.15	0.29	-1.36	9.43	0.14	3.57	-2.60	9.51	22.48
Average	10.19	1.89	-0.53	-6.64	0.63	-6.14	4.99	11.00	2.70	0.32	2.63	2.85	24.82
Weighted average	10.70	2.75	-0.01	-6.27	0.74	-5.96	5.70	10.37	2.88	1.15	3.36	2.19	29.50

Sources: See table 6.

Table 9: Index of spatial concentration (1925 – 1937)

	1925-1928	1929-1934	1935-1937
Mineral industry	0.166	0.147	0.135
Metallurgy	0.331	0.359	0.304
Mechanics and electrics	0.322	0.350	0.363
Chemicals	0.286	0.317	0.339
Textiles	0.551	0.581	0.582
Paper	0.273	0.286	0.271
Leather	0.199	0.231	0.231
Wood	0.243	0.143	0.139
Food	0.216	0.241	0.250
Clothing	0.264	0.319	0.324
Building	0.180	0.205	0.208
Printing	0.334	0.365	0.388
Total industry	0.240	0.263	0.251

Sources: See table 6.

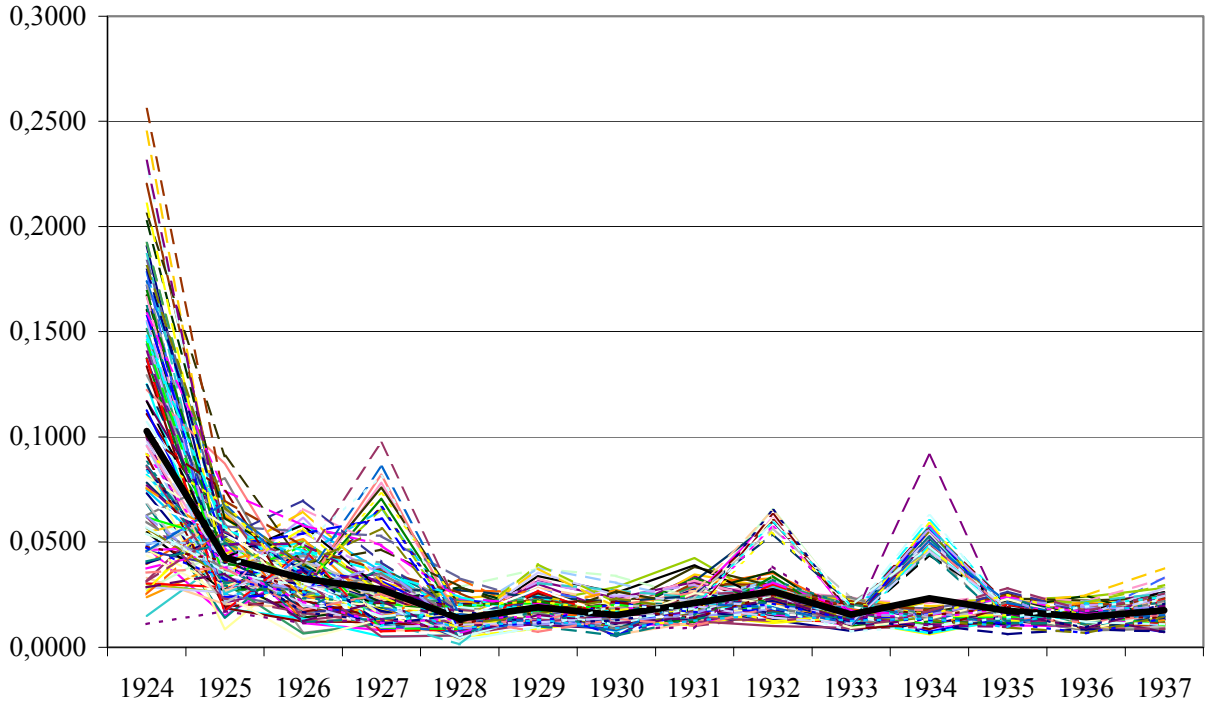
Table 10: Pooled OLS-estimation with location and industry FE
– dependent variable: $\log(r_i^k)$

	1926-1934		1926-1928		1929-1931		1932-1934	
	Coeff.	*(t-stat)*	Coeff.	*(t-stat)*	Coeff.	*(t-stat)*	Coeff.	*(t-stat)*
Location FE	yes (sig.)							
Industry FE	yes (sig.)							
LOG(MIN)*FUEL?	1.109	*(3.300)*	1.388	*(2.259)*	1.166	*(1.907)*	0.842	*(1.282)*
LOG(LAB)*LAINT?	-0.499	*(-1.481)*	-0.640	*(-1.036)*	-0.799	*(-1.322)*	-0.376	*(-0.564)*
LOG(SKS)*SKLINT?	23.411	*(5.688)*	27.282	*(3.543)*	34.212	*(3.772)*	40.103	*(3.607)*
LOG(PAT)*PATINT?	-0.153	*(-0.525)*	-0.590	*(-1.144)*	-0.368	*(-0.765)*	0.746	*(1.889)*
LOG(MP)*DINTER?	0.047	*(0.117)*	-0.684	*(-0.785)*	-0.336	*(-0.380)*	-0.245	*(-0.292)*
No. of Obs.	450		150		150		150	
Adj. R2	0.37		0.33		0.38		0.32	

Table 11: Market power? Pooled OLS-estimation with FE
– dependent variable: $\log(r_i^k)$

	1926-1934		1926-1928		1929-1931		1932-1934	
	Coeff.	*(t-stat)*	Coeff.	*(t-stat)*	Coeff.	*(t-stat)*	Coeff.	*(t-stat)*
Location FE	yes (sig.)							
Industry FE	yes (sig.)							
LOG(MIN)*FUEL?	0.085	*(0.384)*	0.285	*(0.710)*	0.063	*(0.160)*	-0.280	*(-0.692)*
LOG(LAB)*LAINT?	0.733	*(2.958)*	0.739	*(1.603)*	0.551	*(1.244)*	1.214	*(2.636)*
LOG(SKS)*SKLINT?	21.373	*(5.981)*	24.439	*(3.610)*	31.172	*(4.057)*	34.024	*(3.956)*
LOG(PAT)*PATINT?	-0.411	*(-1.553)*	-0.597	*(-1.241)*	-0.463	*(-0.927)*	0.357	*(1.158)*
LOG(MP)*DIN?FS?	2.878	*(13.807)*	2.738	*(6.730)*	3.059	*(6.956)*	2.8461	*(8.970)*
							64	
No. of Obs.	450		150		150		150	
Adj. R2	0.48		0.42		0.48		0.47	

Graph 1: Annual Standard Deviation of relative Prices across 16 Vojvodships (1924-1937)



Sources : for 1924 – 1929: *Rocznik Statystyczny*, Warsaw (diff. years); for 1930 – 1937 *Statystyka Cen*, Warsaw (diff. years).

Maps

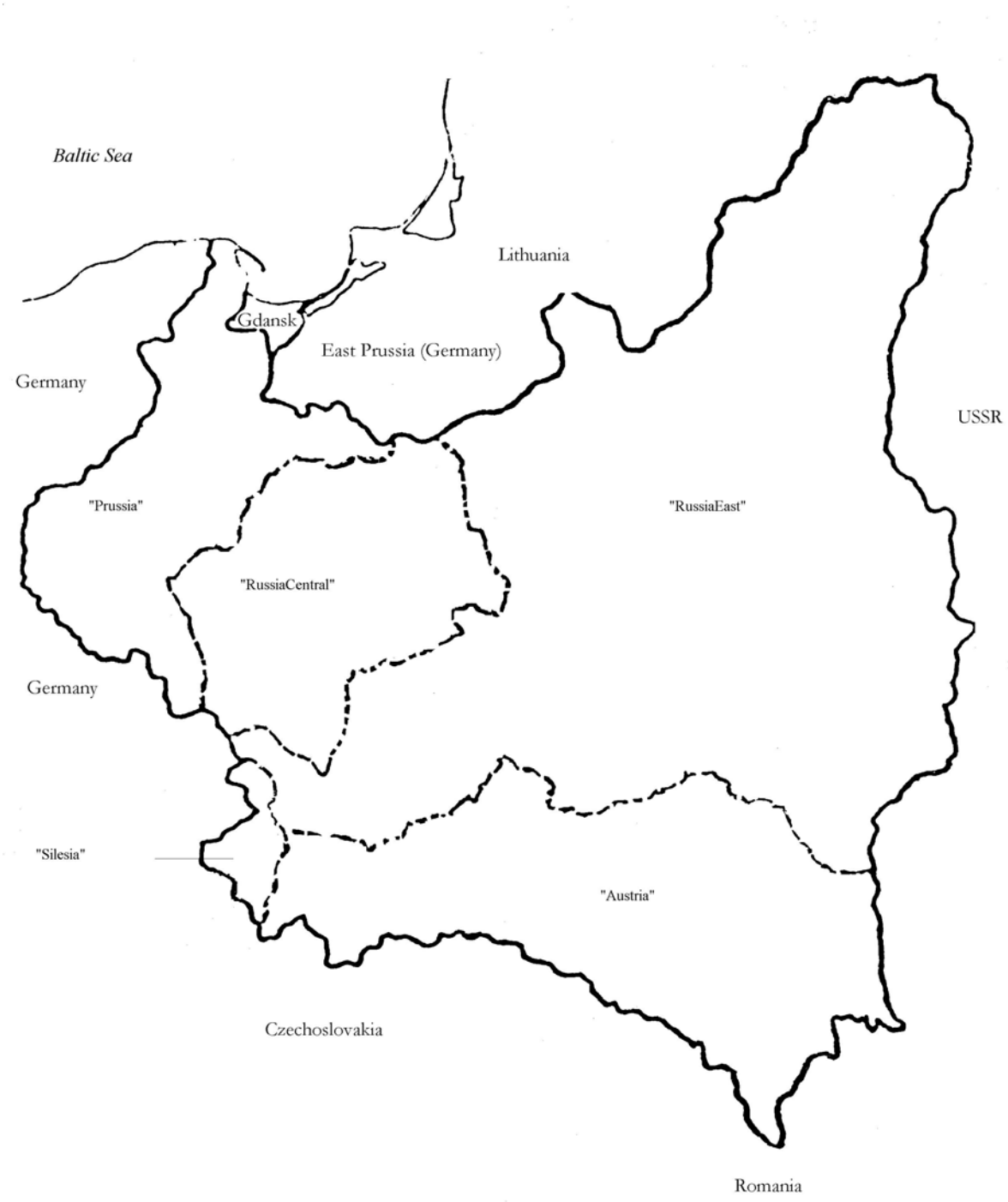
Map 1: Poland as in 1921 and the former partition borders

Based on Rocznik Statystyczny 1928, Warsaw (1929).

Map 2: Administrative Structure - Vojvodships (1921-1938)

Based on Rocznik Statystyczny 1928, Warsaw (1929).

Map 3: Defining Five Big Areas



Based on Rocznik Statystyczny 1928, Warsaw (1929).

Appendix: Data sources and description to section 2

Evidence on industry characteristics

- Fuel intensity (Mineral deposits)

Data: Coal usage from Komitet Ekonomiczny Ministrów (1928), *Sprawozdanie Komisji Ankietowej. Badania Warunków i Kosztów Produkcji oraz Wymiany, Tom V, Węgiel,* Warsaw and other fuel usage as in 1936 (Coal, Coke, Charcoal, Wood, Petrol) from GUS, *Mały Rocznik Statystyczny [MRS] 1939*, Warsaw (1939).

- Labour intensity

Data: Annual labour costs (skilled and unskilled) as share of total sales from *MRS (1939)*.

- Skill intensity

Data: share of non-manual workers in total workforce, mean of 1932-1937 from *MRS (1939)*.

- Patent intensity (R&D)

Data: total announced patents and announced industry-specific patents, mean of 1924-1937 from Urząd Patentowy, *Wiadomości Urzędu Patentowego*, Warsaw (1924-1937).

- Intermediates per output

Data: share of intermediate products in gross production value, Polish industry proxied by German industry as in 1936 from Reichsamt fuer Wehrwirtschaftliche Planung, *Die Deutsche Industrie*, Berlin (1939).

- Mean firm size (as a proxy for plant-level IRS)

Data: total annual sales per number of active plants as in 1937 from *MRS (1939)*.

Evidence on location characteristics

- Mineral output

Data: total export shipments (within area, within Poland, foreign) of minerals from Ministerstwo komunikacji, Centralne Biuro statystyki przewozów P.K.P., *Rocznik statystyczny przewozu towarów na polskich kolejach państwowych według poszczególnych rodzajów towarów* [SYToR], Warsaw, (1925-1937).

- Labour abundance

Data: total population per arable land; arable land as in 1931 from *MRS (1939),* population data interpolated by census data 1921 and 1931 from GUS, *Rocznik Statystyczny Rzeczypospolitej Polskiej (1928)* and *MRS (1939)*.

- Skilled labour

Data: share of people literate in Polish language in total population, interpolated by census data 1921 and 1931 from GUS, *Rocznik Statystyczny Rzeczypospolitej Polskiej (1928)* and *MRS (1939)*.

- Patent (R&D) – production

Data: number of announced patents by residence of announcer (vojvodship) from Urząd Patentowy, *Wiadomości Urzędu Patentowego*, Warsaw (1924-1937).

- Market Potential 1926-1934

Data: share of total Polish market potential, estimation based on gravity model of domestic trade as in Wolf (2003, pp. 47-69), trade date from *SYToR* (see mineral output).

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